Pigs *can* fly!

By Indraneil Das

When asked to write this piece, I was reminded of a childhood riddle. *What do flying snakes and flying foxes have in common?* Answer: *both are misnomers* (the flying snake does not fly, and the flying fox is not a fox!).

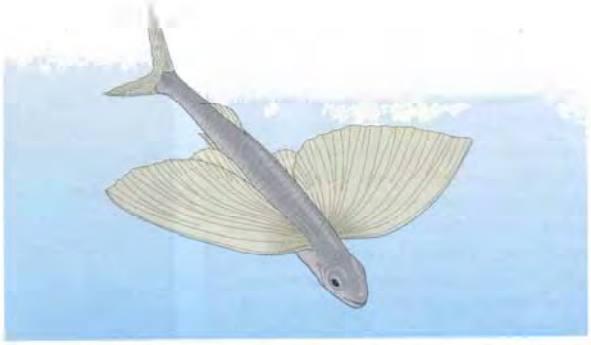
If you happen to be sitting on a tree in a tropical rain forest, and want to get to another tree some distance away, there are two ways of achieving your goal. You can climb down to the ground and ascend the other tree— or you can leap off your tree and hope for dear life that you will make it to the one you want to get to.

Animals living on trees in tropical forests have to be adept at getting from one tree to another. Anyone who has watched leaf monkeys at work will have seen how agile and surefooted they are, leaping between branches and trees, moving through the canopy as surely as we would stroll on the street.

Leaping between trees is all very well however, if your happen to be about the size of a monkey. With long arms, it is possible to get enough 'swing' to fling yourself with sufficient speed. But if you happen to be a quarter the size of a leaf monkey, the problem is rather more formidable, and there is a good chance you will fall short.

In the course of evolution, some groups of smaller tropical forest animals, ranging from amphibians to mammals, have solved this problem by developing aerodynamic membranes to help them glide through the air. This way, if they are high enough on a tree, they can leap off and fall some distance while gathering speed, then orientate themselves more or less horizontally, and using the aerodynamic lift from their gliding membranes, direct themselves towards a tree of their choice.

The gliding membranes of these animals (called patagia, singular: patagium) may be folds of [illegible] along the sides of the body (as seen in [illegible] squirrels), enlarged webs between the fingers and toes (frogs) or through flattening of the body (tree snakes). Gliding seems to have evolved independently in these



independent and distinctive groups in the forests of Asia and Australia. For reasons that are not clear, no gliding animals occur in the forests of South America (but more on that later).

Flying lizards

The so-called flying dragons of the genus *Draco*, a member of the same family as the familiar garden lizards, are perhaps the best example of animals adapted to gliding. A single species occurs in Kerala, south-western India, but none have ever been recorded from Sri Lanka The genus *Draco* includes a large number of gliding lizards from the forests of Asia, from south-western India to Indonesia and the Philippines. Males frequently sport a throat sac that is larger than that shown by the females. The sac is typically used for courtship, though the British naturalist Charles McCann thought that it, along with lateral skinny expansions of the neck, possibly functions as a rudder during 'flights'. In addition to serving as aerofoils for gliding, the skin flaps probably also help break the animal's fall by acting as a parachute. The flaps are normally kept folded, but when fully extended, are almost semicircular in the south Indian *Draco dussumieri*. But the most remarkable development in these lizards is the wing-like structure,

Draco dussumieri, the flying lizard of the Western Ghat mountains of Kerala, southern India.

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composed of a membrane that can be opened out into a semicircle, supported by five to seven elongated, 'floating ribs'. The English naturalist Stanley Flower saw one that expanded this amazing structure, and glide 20 yards through the air!

Flying snakes

Flying snakes were subjected to examination as long ago as 1906, by the English naturalist-explorer Robert Shelford, in a paper in the *Proceedings of the Zoological Society of London.* Shelford reported that snakes of the genus *Chrysopelea* were able to flatten their bodies in 'flight'. Shelford thought that the distinct keels on the underside of the snake were the most important factor facilitating the alteration of body shape during 'flight'. As a result, flying snakes are able to flatten and broaden their bodies, giving themselves a larger 'wing' area to facilitate gliding and at the same time reduce drag.

The mechanism of flight by certain snakes was also investigated by the famous German herpetologist, Robert Mertens of the Senckenberg Museum in Frankfurt. In a 1970 paper in the journal *Salamandra*, Mertens observed that *Chrysopelea paradisi* (the Red-spotted flying snake) and not the Indian and Sri Lankan flying snake (*C. ornata*) was the real 'parachutist' or 'glider'. *Chrysopelea paradisi* is capable of flattening its body considerably so as to reduce air resistance during 'flight'. Although Mertens thought that *C. ornata* is 'not optimally' adapted to 'parachuting', I have seen this species sail away from one tree to another, and flatten its body more so than most other arboreal snakes. In addition, the local vernacular for this species virtually throughout its range in Sri Lanka and India is equivalent to 'flying snake'. Unfortunately, virtually nothing is known of the behaviour of the endemic northern Sri Lankan flying snake, *Chrysopelea taprobanica*.

Flying frogs

Since the time of Alfred Russell Wallace more than a century ago, 'flying' frogs have been known from the forests of Borneo and other parts of south-east Asia. Wallace's famous observations of the gliding abilities of these frogs are thought to refer to *Rhacophorus nigropalmatus*, the so-called Wallace's flying frog. This is a Kermit look-alike, with a bright green body and strikingly yellow eyes. It is known to cover horizontal distances of up to 7.3 m in a single glide. All tree frogs have well-developed limbs. For gliding however, they have had to develop parachuting structures, comprising large webs and flaps of skin along the elbow and along the heel, and over the vent. When launching themselves into the air, the frogs extend their limbs sideways: the glide path has been described as a parabola. When landing, several things happen to cushion the impact: the broad webs on the hind legs fall open, the limbs are held sideways to the body, and the body is flattened.

Flying squirrels

The giant flying squirrels of the genus *Petaurista* occurs over a wide range within the Sri Lanka – Pakistan – Indonesia triangle. The species best known in Sri Lanka is *Petaurista philippensis*, the Grey flying squirrel, which is occurs from Sri Lanka through India up to Myanmar, Thailand and China. This is a low-altitude forest species, not uncommon in Sri Lanka's wet zone forests (several other species and genera occur in Asia). All flying

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Red-spotted flying snake (*Chrysopelea paradisi*) – a [illegible] ve of *Chrysopelea ornata*, the flying snake that occurs in Sri Lanka [illegible] found in the tropical forests of south-east Asia. These snakes lack speci[illegible] wing-like structures, and merely flatten there bodies like a ribbon when gliding from tree to tree.

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Wallace's flying frog (*Rhacophorus migropalmatus*), a Kermit-lookalike from the forests of Borneo and elsewhere in south-east Asia. Adults rarely descend to the forest floor, and are sighted mainly during the breeding season.

Gliding geckoes, such as Horsfield's gliding gecko (*Ptychozoon horsfieldii*), from south-east Asia, are also reported to parachute, although some observers feel that the flaps of skin on the sides of the body are meant to cut out shadows when the animal is resting. These geckoes have wide webs between their fingers and toes, as well as flaps of skin on the sides of the head, limbs and tail. The body flaps are held out rigidly when the animal leaps.

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squirrels have a furry flight membrane, comprising a flap of skin that extends along the sides of the body, joining the fore and hind limbs. While in flight, the tail functions as a rudder. These animals are capable of flights of 1,000 m or more, descents being in smooth curves. They generally avoiding branches, calculating their flight path so as to land on tree trunks. Where several species occur together, each generally occupies a different height range on the same tree.

The most remarkable of all Asian gliding mammals must be the colugos, which are also referred to as flying lemurs (although this name, as pointed out by the Singaporean naturalist Ivan Polunin, is again a misnomer, the beasts in question neither being flyers nor lemurs). The two living species are so distinct from the flying squirrels that they are grouped within an order (Dermoptera) and family (Cynocephalidae) of their own. Both species of colugo (genus *Cynocepahlus*, meaning 'dog-face') are nocturnal, feeding on leaves, bulbs, as well as plant sap. The colugos show more extensive gliding membranes than that seen in any other group of animals. So effectively do they glide, that a mother can carry its baby on its belly while airborne. While at rest, the mother's patagium is folded into a warm nest for the baby.

So why do all these animals 'fly' through the forests? The answer to this very vexing question is, I think, contained in the question itself. Forests of tropical Asia are characterised by a lack of lianas. On the other hand, lianas typify the rain forests of Africa and South America, forming a network of pathways for arboreal animals to move freely between trees. In south-east Asia and Australia (including both New Guinea and Australia), the lack of lianas, provide no such opportunities, but permits unobstructed glides.

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The so-called flying foxes are in fact bats of the genus *Pteropus*.

The giant flying squirrel, *Petaurista philippensis*. These squirrels inhabit of rain forests in Sri Lanka and India, and are entirely arboreal.

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